



Clinical outcome of surgery techniques in patients with brain abscess

Clinical outcome brain abscess

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Abstract

Aim: Brain abscess is a serious, life-threatening infection. Although a brain abscess could arise without any predisposing risk factors, the well-known risk factors are diabetes mellitus, head trauma, history of cranial surgery, and immunosuppression. For surgical treatment, aspiration and total excision are the techniques used. **Material and Method:** This study was conducted in two different neurosurgery clinics between 2008-2016 with 21 patients treated for brain abscess. Age, sex, the localization of the abscess, number of foci, preoperative and postoperative Glasgow Coma Scale, the size of the abscess, the surgical technique performed, the duration of hospitalization, the duration of antibiotic treatment, and culture results of the patients were compared. **Results:** In our study 15 (71.4%) patients were males and 6 (28.6%) patients were females. Mean age was 44.57 ± 23.40 (range 4-86). Mean abscess volume was 46.85 ± 41.19 cm³. There was no significant difference regarding mortality when the two surgical techniques were compared ($p=0.486$). As the volume of the abscess increases the duration of hospitalization ($p=0.003$), the duration of antibiotic treatment also increases ($p=0.002$). **Discussion:** Although rare, intracranial abscesses have clinical significance due to high morbidity and mortality rates. The success of treatment has significantly increased due to improvements in imaging, surgical technique, bacteriological culture techniques, and antibiotic therapy. A multidisciplinary approach should be considered in managements of patients with brain abscess.

Keywords

Abscess; Aspiration; Total Excision; Outcome

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Introduction

The worldwide incidence of brain abscess among intracranial masses is between 2-8% [1]. Brain abscess arises either via direct route (otitis media, mastoiditis, sinusitis, penetrating head injury, after neurosurgical interventions) or hematogenous route (pneumonia, urinary tract infection, endocarditis, dental infections) [2,3]. Brain abscess firstly starts from a focus and the capsule develops two weeks later [4]. Despite surgical treatment and improved antibiotics, morbidity (8%) and mortality (25%) of brain abscess are still high [5-7]. Surgical treatment of brain abscess is the aspiration of the abscess or total excision of the abscess with its capsule. Total surgical excision is most often recommended in patients who are younger with better Glasgow Coma Scale (GCS) scores, if the abscess is solitary and not located in more sensitive portions of the brain, and if the capsule is present [8,9]. The aim of this study was to show the relationship between the epidemiological and clinical features of the patients who applied to our clinics with brain abscess and the surgical outcome, duration of hospitalization, and duration of antibiotic treatment.

Material and Method

This study includes 21 patients with brain abscess operated in two different neurosurgery clinics between 2008-2016. This retrospective study was conducted with permission from the non-interventional ethics committee of the university. Age, sex, the localization of the abscess, number of foci, preoperative and postoperative GCS, size of the abscess, surgical technique performed, duration of hospitalization, duration of antibiotic treatment, and culture results of the patients were compared. The analyses were done using IBM SPSS (Statistical Package for the Social Sciences) 15.0 (Chicago, USA) package program. Mean \pm standard deviation were used as descriptive statistics. Chi-square, Fischer exact tests and correlation analysis were used for statistical analysis. $p < 0.05$ was accepted as statistically significant.

Results

In the study, 15 (71.4%) of the patients were male and 6 (28.6%) were female. The mean age was 44.57 ± 23.40 (range 4-86 years). The mean age of males was 40.66 ± 24.42 (range 4-86 years) and the mean age of females was 54.33 ± 19.02 (range 34-78 years). 9 (42.9%) of the patients had comorbid chronic illnesses (diabetes mellitus, hypertension, anemia, dementia, rheumatoid arthritis). 4 (19%) of the patients had preoperative fever (Table 1). In 11 (52.8%) patients the abscess was localized at the frontal lobe (Figure 1). In 12 (57.1%) patients abscess aspiration was the surgical technique. The abscess was reached via craniotomy; stereotaxy was not used. In 9 (42.9%) patients surgical excision was performed. In all patients who underwent surgical excision, the abscess was localized at the frontal lobe. The overall mean volume of abscesses was $46.85 \pm 41.19 \text{ cm}^3$. The mean volume of abscesses that were excised surgically was $35.18 \pm 16.76 \text{ cm}^3$; the mean volume of abscesses that were aspirated was $64.37 \pm 61.69 \text{ cm}^3$. Mean duration of hospitalization among patients who underwent surgical excision was 35.16 ± 15.43 days; among patients who underwent aspiration the mean was 46.88 ± 43.26 days (Table

Table 1. Demographic, Clinical, and Microbiological Characteristics of Patients with Brain abscess (N=21)

Factors	N(%) or (Mean)
Age (years)	44,57 \pm 23,40 (range 4-86)
Sex	
Female	6(28,6%)
Male	15(71,4%)
Preoperative Seizure	4(19%)
Traumatic Brain Injury	3(14,3%)
Chronic Disease	9(42,9%)
1	5(23,9%)
≥ 2	4(19%)
Fever	4(19%)
Abscess Location	
Frontal	11(52,8%)
Temporal	4(19%)
Parietal	2(9,5%)
Multiple lobes	4(19%)
Abscess Foci	
1	17(81%)
≥ 2	4(19%)
Preoperative Glasgow Coma Score	
6	1(4,8%)
11	2(9,5%)
14	1(4,8%)
15	17(81%)
Postoperative Glasgow Coma Score	
6	1(4,8%)
11	1(4,8%)
14	2(9,5%)
15	17(81%)
Abscess Volume (cm ³)	46,85 \pm 41,19
Patient Hospital Stay (day)	40,19 \pm 30,24
Antibiotics Treatment (day)	41,85 \pm 17,64
Abscess Culture	
Gram (+)	13(61,9%)
Gram (-)	2(9,5%)
Tuberculosis	1(4,8%)
Negative	5(24%)
Follow-up (day)	620,40 \pm 561,65
Exitus	2(9,5%)

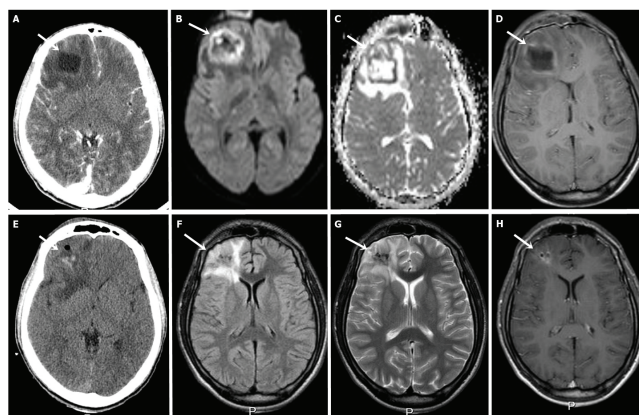


Figure 1. Preoperative enhanced CT (A), Preoperative DWI MRI (B-C), preoperative T1 weighted enhanced MRI showing abscess (D), postoperative enhanced CT (E), Postoperative DWI MRI (F-G), postoperative T1 weighted enhanced MRI (H).

Table 2. Comparison of Surgery Techniques

	Aspiration	Excision
Abscess Volume (cm ³)	64,37±61,69	35,18±16,76
Patient Hospital Stay (day)	46,88±43,26	35,16±15,43
Antibiotics Treatment (day)	43,66±22,03	40,36±14,05
Follow-up (day)	449,81±429,37	828,88±1028,79
Abscess Location		
Frontal	2(9,5%)	9(42,9%)
Temporal	4(19%)	0
Parietal	2(9,5%)	0
Multiple lobes	4(19%)	0
Abscess Culture		
Gram (+)	7(41,2%)	6(35,3%)
Gram (-)	1(5,9%)	1(5,9%)
Tuberculosis	0	1(5,9%)
Negative	3(17,7%)	2(11,8%)
Exitus	2 (9.5%)	0

2). There was no statistically significant difference between those two groups ($p=0.669$). There were two exitus in patients for whom aspiration was performed. There was no difference between the two surgical techniques in terms of mortality ($p=0.486$). As the volume of the abscess increased, the duration of hospitalization ($p=0.003$) and the duration of antibiotic treatment ($p=0.002$) also increased.

Discussion

The success in treatment of brain abscess has increased significantly with development in imaging, surgical techniques, bacteriological culture techniques, and antibiotic treatment. The incidence of brain abscess is increased in immunosuppressed patients [10].

In brain abscess, headache is a common symptom, while fever and clouding of consciousness are uncommon [2]. In our study, 15 (71.4%) patients had headache, 4(19%) had preoperative fever, and 2 (9.5%) had clouding of consciousness.

Although personality disorders are not frequent, they may be seen with frontal lobe involvement. In a study, Brouwer et al. showed that 25% of the patients with brain abscess applied to the emergency room with seizures [2]. In our study 11 (52.8%) patients had frontal lobe abscess and similarly 4 (19%) patients had preoperative seizures and applied to the emergency room. In a meta-analysis from Brouwer et al. 70% of the patients with brain abscess were males [2]. The most common predisposing cause was otitis media/mastoiditis (33%). In our study 15 (71.4%) patients were males and 6 (28.6%) were females. 9 (42.9%) patients had a history of chronic illnesses and 4 (19%) patients had otitis media/mastoiditis.

Brain abscess is typically seen as a hyperintense lesion on diffusion weighted imaging (DWI) and as a hypointense lesion on coefficient images [2]. Reddy et al. reviewed 147 cases with intracranial mass lesion and concluded that DWI magnetic resonance imaging (MRI) has a sensitivity and specificity of 96% when differentiating brain abscesses from primary and metastatic brain tumors [11]. In our study, all patients who applied to the E.R. underwent Brain Computed Tomography (CT) firstly, then conventional and DWI MRI for tumor-abscess discrimination.

Mamelak et al. recommend surgical treatment for abscesses larger than 2.5 cm in diameter [12]. If there are multiple abscesses, surgical intervention should be performed on the largest focus for the diagnosis [13]. In our study, the mean abscess volume was 46.85 ± 41.19 mm³. 4 (19%) patients had multiple foci of abscesses and the surgical intervention was done based on the selection of the largest abscess located at the preferred site of the cortex.

In recent years, 70% of the patients with brain abscess has favorable prognosis [13]. In an editorial, Brouwer et al. determined that early antibiotic treatment within two days of diagnosis of brain abscess is related to better prognosis. The duration of antibiotic therapy for brain abscess is between 6-8 weeks. Longer treatment is not recommended due to metronidazole-related neuropathy [13]. Arlotti et al. stated that lower preoperative GCS is related to higher mortality rates [14]. In our study 3 patients had GCS<12 preoperatively, and 2 of those patients had GCS<12 postoperatively. Two patients died during postoperative follow-up.

Brouwer et al. reviewed 6,663 patients in a meta-analysis; 68% of the patients were culture positive and 32% were culture negative. Among the culture positive patients the most common bacteriae was *Streptococcus* spp. with 34%, followed by *Staphylococcus* spp. (18%), and gram negative species (15%) [2]. In our study 13(61.9%) patients had gram positive, 2(9.5%) had gram negative proliferation, and 5(24%) patients were culture negative.

In a meta-analysis Zhai et al. reported that residue of 50% of the volume of abscess remained, as determined by postoperative brain CT [9]. In this study, surgical excision and surgical aspiration were compared. The percent of residue was higher in the surgical aspiration group. The need for re-operation was higher with the surgical aspiration method. The two surgical technique were compared in terms of neurological functions by using the Modified Rankin Scale at postoperative third month and no significant difference was found. There was no difference when mortality rates were compared. Duration of antibiotic therapy and duration of hospitalization was significantly shorter in the surgical excision patients.

Ratnaik et al. compared surgical excision and aspiration. The aspiration technique was related to longer survival rates. Mean mortality of aspiration was 6.6% and mean mortality of surgical excision was 12.7% [15].

In 12 (57.1%) patients aspiration of the abscess was performed and in 9 (42.9%) patients surgical excision was performed. 4(19%) patients were re-operated due to clinical and radiological progression during their follow-ups. All of those patients had previously undergone aspiration of the abscess. 6 (28.6%) patients had wound site infection postoperatively, healed with follow-up and dressings. Mean duration of hospitalization of the patients who underwent surgical excision was 35.16 ± 15.43 days and it was 46.88 ± 43.26 days for patients who underwent aspiration. There was no significant difference between the two groups. In our study, we found that as the volume of the abscess increases the duration of antibiotic therapy and hospitalization also lengthens. Therefore the volume of the abscess is related to the duration of hospitalization. A multidisciplinary approach is used in antibiotic selection, the therapy differs

from patient to patient and antibiotic therapy may be revised if there is no adequate clinical and radiological response to initial or subsequent antibiotic therapy. This leads to a longer duration of antibiotic therapy and therefore a longer duration of hospitalization.

Although rare, intracranial abscesses have clinical significance due to high morbidity and mortality rates. The success of treatment has significantly increased due to improvements in imaging, surgical technique, bacteriological culture techniques, and antibiotic therapy. A multidisciplinary approach should be considered in management of patients with brain abscess.

Animal studies:

All institutional and national guidelines for the care and use of laboratory animals were followed. No laboratory animals were used for this study.

Human studies:

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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